# Abstract

The present investigation is focused on the thermal performance of building materials, specifically their thermal transmittance, and consequent impact on building envelope and building thermal performance. Thermal performance of building materials plays a crucial role in regulating indoor thermal comfort when suitably integrated as part of the building envelope. Studies into thermal performance of building materials are few, particularly in the context of designing building blocks to achieve a particular thermal transmittance in buildings. Such studies require both theoretical (numerical) investigations augmented with experimental investigation into material thermal performance. A unique contribution of this study has been assessing the temperature-dependent performance of building material and their influence on thermal conductivity. The thermal performance of conventional and alternative (low energy) building materials have also been investigated to assess their suitability for naturally ventilated building in salient climatic zones in India. The study has also investigated the impact of varying mix proportions in Cement Stabilized Soil Block on thermal performance. There is little evidence of such studies, involving both experimental and theoretical studies, tracing the thermal performance of building materials to building performance.

The current study involves three parts: studying thermo-physical properties of building materials, building-envelope performance evaluation and case-study investigation on buildings in various climatic zones. The thermo-physical study involves understanding the role of materials mix-proportion, composition, and microstructure for its influence on building-envelope thermal performance. Studies into building envelope performance for conventional and alternative building materials, includes, steady and dynamic thermal performance parameters. As part of the study, a calibrated hot-box thermal testing facility has been tested to experimentally determine the thermal performance of building envelopes. Case-study investigation involves real-time monitoring and simulation based assessment of naturally ventilated buildings in three climatic zones of India. The study finds noticeable temperature-dependent performance for various building materials tested. However, their impact on overall thermal performance of buildings is limited for the climatic zones tested. Further, the study validates the hitherto unexplored possibility of customizing building materials for specific thermal performances.